

WHAT IS CLAIMED IS:

1. A MEMS sensor for measuring stress corrosion cracking of a material of interest, comprising:

a substrate;

5 an electrically conductive cantilever beam
fabricated upon the substrate, the beam having a fixed
end attached to the substrate and having a free end, and
the beam being made from the material of interest; and
at least one electrical connection to the beam.

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2. The MEMS sensor of Claim 1, further comprising
at least one actuator fabricated on the substrate,
operable to apply stress to the beam.

3. A MEMS sensor for measuring stress corrosion cracking of a material of interest, comprising:

a substrate;

an electrically conductive cantilever beam

5 fabricated upon the substrate, the beam having a fixed end attached to the substrate and having a free end, and the beam being made from the material of interest;

at least two conductive pads fabricated on the substrate adjacent the length of the beam; and

10 conductive leads for electrically connecting the conductive pads to the beam.

4. The sensor of Claim 3, further comprising at least one actuator fabricated on the substrate, operable
15 to apply stress to the beam.

5. The sensor of Claim 4, wherein the actuator moves the beam horizontally over the surface of the substrate.

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6. The sensor of Claim 3, wherein the beam is notched to encourage cracking to occur at a predetermined location on the beam.

25 7. The sensor of Claim 3, further comprising a scale fabricated at the free end of the beam.

8. The sensor of Claim 3, wherein the beam has single arm.

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9. The sensor of Claim 3, wherein the beam has a double arm.

10. The sensor of Claim 9, wherein the conductive
5 pads are along the length of a first arm, and further comprising conductive pads along the length of a second arm, and wherein the conductive leads provide an electrical connection to each of said pads.

10 11. The sensor of Claim 3, wherein the conductive pads are fixed.

12. The sensor of Claim 3, wherein the conductive pads are moveable.

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13. A method of measuring stress corrosion cracking of a material of interest, comprising the steps of:

placing a MEMS sensor in an environment of interest, the MEMS sensor having a substrate, a cantilevered beam
5 with a free end and a fixed end attached to the substrate, and having electrical connections to the beam to at least two points along the length of the beam;

wherein the beam is made from the material of interest;

10 applying stress to the beam;
exposing the beam to environmental corrosion; and
measuring the electrical resistance along the length of the beam.

15 14. The method of Claim 13, further comprising the step of notching the beam to encourage cracking to occur at a predetermined location on the beam.

20 15. The method of Claim 13, wherein the step of applying stress is performed such that the beam moves horizontally across the substrate.

25 16. The method of Claim 13, wherein the beam is divided into two arms extending from the fixed end of the beam, and wherein the step of applying stress is performed such that stress is applied to one of the arms.

30 17. The method of Claim 13, wherein the beam has a single arm, to which stress is applied and whose resistance is measured.

18. The method of Claim 13, wherein the step of applying stress is performed with at least one actuator integrated onto the substrate.

19. A MEMS sensor for measuring stress corrosion cracking of a material of interest, comprising:

a substrate;

an electrically conductive cantilever beam

5 fabricated upon the substrate, the beam having a fixed end attached to the substrate and having a free end, and at least a portion of the length of the beam being made from the material of interest; and

a capacitance meter fabricated adjacent the free end
10 of the beam and operable to measure the capacitance between the free end of the beam and the meter.

20. The sensor of Claim 19, wherein the beam is entirely made from the material.

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21. The sensor of Claim 19, further comprising at least one actuator fabricated on the substrate, operable to apply stress to the beam.

22. A method of measuring stress corrosion cracking of a material, comprising the steps of:

placing a MEMS sensor in an environment of interest, the MEMS sensor having a substrate, a cantilevered beam
5 with a free end and a fixed end attached to the substrate, and having an electrical connection to the beam;

wherein at least a portion of the beam is made from the material;

10 applying stress to the beam;
exposing the beam to environmental corrosion;
placing a capacitance meter near the free end of the beam; and
measuring the electrical capacitance between the
15 free end of the beam and the capacitance meter.

23. The method of Claim 22, wherein the step of applying stress is performed with at least one actuator integrated onto the substrate.

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